

Hospitalizations for childhood asthma in Athens, Greece, from 1978 to 2000

Priftis K, Panagiotopoulou-Gartagani P, Tapratzi-Potamianou P, Zachariadi-Xypolita A, Sagriotis A, Saxoni-Papageorgiou P. Hospitalizations for childhood asthma in Athens, Greece, from 1978 to 2000. *Pediatr Allergy Immunol* 2005; 16: 82–85. © 2005 Blackwell Munksgaard

Trends in rates of asthma admissions among children have shown a variety of patterns in different countries in the last decades. We undertook the present study to determine the time trends in asthma admissions and readmissions of children in Athens, Greece. Data were obtained retrospectively from hospital registries of the three main children's hospitals in Athens from 1978 to 2000. Children admitted with the diagnoses of asthma, asthmatic bronchitis or wheezy bronchitis were included. Hospital admission rate for asthma among children 0–14 yr from 1978 to 2000 rose by 271% ($p < 0.001$). The rise in rates among those aged 0–4 and 5–15 yr were 250% and 276%, respectively. The mean annual increase in admission rate was 12.2% for 1978–1987, 4.7% for 1988–1993 and 0.6% for 1994–2000. The readmission rate among children 0–14 yr was increased from 15.3% to 23.3%. A positive correlation between admission and readmission rates in all age groups was observed. In conclusion, our findings show an increase in the childhood asthma admission rate in Athens in late 1970's and during the 1980's, which has decelerated in the 1990's, particularly in the second-half of the decade. The readmission rate paralleled that of admissions over the entire study period.

K. Priftis¹, P. Panagiotopoulou-Gartagani², P. Tapratzi-Potamianou³, A. Zachariadi-Xypolita², A. Sagriotis⁴ and P. Saxoni-Papageorgiou³

¹Allergology-Pulmonology Department, Penteli Children's Hospital, 15236 P. Penteli, Greece, ²1st Paediatric Department, University of Athens, 'Agia Sophia' Children's Hospital, Greece, ³2nd Paediatric Department, University of Athens, 'P & A Kyriakou' Children's Hospital, Greece, ⁴Bio statistician, Greece

Key words: childhood asthma; hospitalization; admission; readmission; epidemiology

Kostas N. Priftis, Allergology-Pulmonology Department, Penteli Children' Hospital, 15236 P. Penteli, Greece
Tel.: +30 1 8036484
Fax: +30 1 6131173
E-mail: kpriftis@otenet.gr

Accepted 9 June 2004

During the past decades, increasing hospital admission rates for childhood asthma have been reported in many countries. However, the pattern of increase during the last years appears to have changed (1–3).

A considerable relationship between childhood asthma admission and readmission rates has also been observed (4, 5). A reduction in readmissions for asthma has been detected in some countries during the last years, and the increased use of asthma anti-inflammatory therapy has been implicated as a causative factor (6–8).

In a previous study, we found a steady increase in hospital admission rates for childhood asthma in the greater Athens region during the 1978–1988 decade (9). We undertook the present study to determine possible time trends in asthma admissions and readmissions

of children in the same population group until the year 2000.

Methods

Study design – population

As in the previous study, (9) data were obtained from the hospital registries of the three main Children's Hospitals of Athens for the 1978–2000 period, covering approximately 78–80% of the paediatric beds of metropolitan area of Athens, inhabited by a population of approximately 2,500,000 in 1978 to 4,200,000 in 2000.

All children admitted with the diagnosis of 'asthma', 'asthmatic bronchitis' or 'wheezy bronchitis', living in the above-mentioned region were included. Asthma admission rates, after adjusting for paediatric beds that are not accounted for

(approximately 20–22% of total number), were expressed per 10^5 population aged the same as the studied groups. The estimation of the population for each year of the study period was based on the 1981 and 1991 national census.

As readmission was defined as the second, or admission of higher order, that occurred within the same calendar year. The annual readmission rate was calculated by dividing the number of readmissions by the admissions in the same calendar year, and expressed as percentage.

Statistical methods

Admission and readmission trends were assessed by Poisson regression analysis and chi-square test for trend. Spearman (r_s) correlation coefficient was used in order to assess the correlation between admission and readmission rates in all age groups. The statistical analysis was carried out with the software product SAS, version 8.1 (SAS Institute, Cary, NC, USA).

The study was approved by the Ethics Committee of the Hospital.

Results

There was a total of 25,412 asthma admissions during the entire study period (male/female ratio: 1.44), the 18,950 among the 0–4 yr age group (male/female ratio: 1.51). The trend of children's admission rates for acute asthma is shown in Fig. 1.

Admission rate for the 0–14 yr age group rose from 1978 to 2000 by 271% ($p < 0.001$), for the 0–4 and 5–14 yr age groups by 250% and 276%, respectively. However, the highest annual admission rates for the 0–14 and 0–4 yr age groups were noted in 1996 ($340/10^5$ and $1124/10^5$), while that for the 5–14 yr age group was noted in 1994 ($397/10^5$).

The mean annual increase of admission rates was 12.2% for 1978–1987, 4.7% for 1988–1993, but 0.6% for the more recent period. The corresponding mean annual changes of admission rates were 13%, 4.6% and –1.8% for the younger age group, and 14.3%, 5.6% and –2.9% for older children, respectively, without any significant difference between the two age groups.

The annual readmission/admission ratio over the study period is shown in Fig. 2. It increased among children 0–14 yr from 15.3% to 21.1% with a mean annual readmission rate of 19.2% ($p < 0.001$). The mean annual increase of readmission rates was 3.6% for 1978–1987, 0.5% for 1988–1993, but –0.6% for the last period.

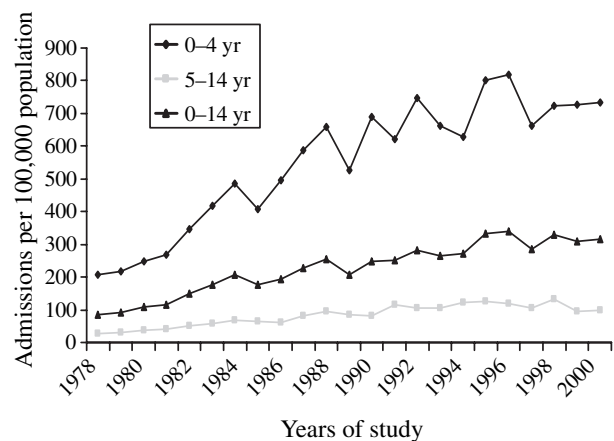


Figure 1. Trends in hospital admissions for asthma in children aged 0–14, 0–4 and 5–14 yr, in Athens over the 1978–1998 period.

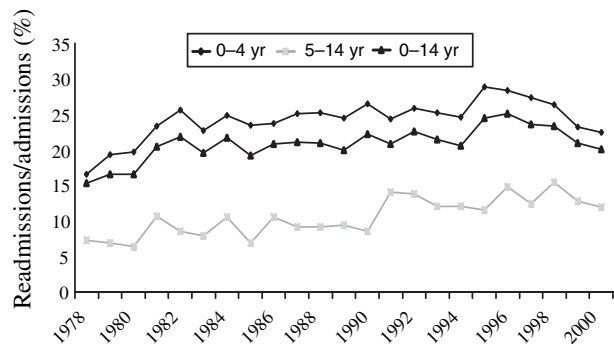


Figure 2. Trends in annual readmission/admission ratio for asthma in children aged 0–14, 0–4 and 5–14 yr, in Athens over the 1978–1998 period.

No significant differences were detected between mean readmission rates of the younger vs. older age groups, but there was a significant positive correlation between admission and readmission rates in all age groups ($p < 0.001$).

Discussion

The principle finding of the present study is the increasing rate of hospital admissions for acute childhood asthma in the metropolitan area of Athens during the first 16 yr of the 1978–2000 period and the more or less stabilization during the last few years. The same pattern was found with readmissions with a strong correlation between asthma admissions to the readmission rate.

We maintain that our data reliably reflect admissions for acute asthma during the study period. The three source-hospital registries utilized represent the 78–80% of paediatric beds in the metropolitan area of Athens. The remaining

percentage consists of small paediatric wards in general public or private Athens' hospitals. This holds true for the entire study period.

Diagnostic shift, i.e. labelling of asthmatic or wheezy bronchitis as asthma, as a possible cause for the increasing admission rates, has been discussed (1). However, that could not be the case in our study, since patients with all three diagnostic labels have been included in the analysis and they were treated for acute asthma, regardless of the diagnostic label and the year of admission. A diagnostic shift of 'acute bronchiolitis' to 'asthma' cannot be ruled out in the 1980's and early 1990's. Such diagnostic shift should have influenced admission rates in the younger age group but more pronounced was the increasing rate in the 5–14 yr age group.

The annual admission rate for asthma exacerbation among children in the metropolitan area of Athens appears rather low when compared to data given by certain studies (2, 3), but it is higher than the rates reported by others (1, 3). Our readmission rates are also in the lower end of the spectrum of reported values (2–4).

Our results agree with the change in trends of asthma admissions during the more recent years that has been reported by a number of studies from various countries in all or more specific age groups (2, 5, 6). It seems that the more resistant to that change age group is the 0–4 yr (1, 2, 4, 5) although it was not observed in our study.

Several causative factors have been proposed in order to explain the increase in asthma admissions during the last decades and the 'plateau' or the decrease observed thereafter, in the more recent years. These factors include changes in prevalence and/or severity of asthma, changing attitudes of practicing physicians towards acute disease and strategic shifts in insurance policies.

A true increase in the prevalence of current and lifetime asthma in the last 20 yr among pre-adolescent children has been recently reported in Patras, Greece (10). Therefore, an increase in prevalence *per se*, with unchanged disease severity, may account, at least in part, for the increase in asthma admissions. Another, explanation is that the disease has become more severe. Anderson has reported that the number of previous admissions may reflect the severity or the behaviour of the illness (4). The strong positive correlation between annual admission and readmission rate in the present study may support a worsening of asthma severity.

There were no major changes in the National Health System or in insurance and health policies in Greece to encourage a lower threshold

for referral or admission for acute asthma over the study period. On the other hand, the extensive discussions on the inflammatory nature of asthma and the dissemination of guidelines on the management of the disease, have most likely alerted and educated physicians in the community in the treatment of asthma, and encouraged them to adopt more aggressive use of anti-inflammatory prophylactic medication (6). Improved patient education and more aggressive treatment in the hospital emergency room may have also contributed to the 'plateau' in asthma admission rates in the more recent years (11).

The parallel increase in the rates of admissions and readmissions for acute asthma in both age groups of children analyzed, in association with the improved management of the disease over the last decade, raise the possibility of an increase in asthma severity. At any event, our findings indicate that there is a persisting 'hard core' of 'difficult' asthma within the spectrum of the disease. Such difficult to manage asthma, eventually resulting in repeat exacerbations and readmission of these patients to the hospital, most likely encompasses children with persistent underlying airway inflammation as well as asthmatics who do not comply with physicians' instructions or have poor inhalation skills (12). It may well be the case that asthmatics readmitted for acute exacerbation of their disease need not only to be treated more aggressively, but also to be better educated on the proper use of their anti-asthma medication (7, 8, 13). Our results differ from reports from Scandinavian countries that show an increase in first admission rate but a decrease in readmissions over the 1980–1995 period (5). Such differences probably reflect more effective asthma control, resulting in the prevention of severe exacerbations in these countries.

In conclusion, our findings show a continuous parallel increase in asthma admission and readmission rates in the greater Athens area during the first 15 yr of the studied period. This increase has followed by a deceleration and admission rates have essentially stabilized during the last few years. Our results can be accounted for by the continuing increase in asthma prevalence in Greece and support the persistence of a 'hard core' of a difficult to treat asthma. However, it should be considered that there is room for further decrease in acute asthma admission and readmission rates by further improvements in anti-asthma therapy and patient education according to the recently proposed guidelines.

References

1. GERGEN PJ, WEISS KB. Changing patterns of asthma hospitalization among children: 1979 to 1987. *JAMA* 1990; 264: 1688–92.
2. TO T, DICK P, FELDMAN W, HERNANDEZ R. A cohort study on childhood asthma admissions and readmissions. *Pediatrics* 1996; 98(2 Pt 1): 191–5.
3. MALMSTROM K, KORHONEN K, KAILA M, et al. Acute childhood asthma in Finland: a retrospective review of hospital admissions from 1976 to 1995. *Pediatr Allergy Immunol* 2000; 11: 236–40.
4. ANDERSON HR. Increase in hospital admissions for childhood asthma: trends in referral, severity, and readmissions from 1970 to 1985 in a health region of the United Kingdom. *Thorax* 1989; 44: 614–9.
5. JONASSON G, LODRUP CARLSEN KC, LEEGAARD J CARLSEN KH, MOWINCKEL P, HALVORSEN KS. Trends in hospital admissions for childhood asthma in Oslo, Norway, 1980–95. *Allergy* 2000; 55: 232–9.
6. WENNERGREN G, KRISTJANSSON S, STRANNEGARD IL. Decrease in hospitalization for treatment of childhood asthma increased use of antiinflammatory treatment, despite an increase of prevalence of asthma. *J Allergy Clin Immunol* 1996; 97: 742–8.
7. KORHONEN K, REIJONEN TM, REMES K, MALMSTROM K, KLAUKKA T, KORPPI M. Reasons for and costs of hospitalization for pediatric asthma: a prospective 1-year follow-up in a population-based setting. *Pediatr Allergy Immunol* 2001; 12: 331–8.
8. WEINMANN S, KAMTSIURIS P, HENKE KD, WICKMAN M, JENNER A, WAHN U. The costs of atopy and asthma in children: assessment of direct costs and their determinants in a birth cohort. *Pediatr Allergy Immunol* 2003; 14: 18–26.
9. PRIFTIS K, ANAGNOSTAKIS J, HAROKOPOS E, ORFANOI I, PETRAKI M, SAXONI-PAPAGEORGIOU P. Time trends and seasonal variation in hospital admissions for childhood asthma in the Athens region of Greece: 1978–88. *Thorax* 1993; 48: 1168–9.
10. ANTHRACOPOULOS M, KARATZA A, LIOLIOS E, TRIGA M, TRIANTOU K, PRIFTIS K. Prevalence of asthma among schoolchildren in Patras, Greece: three surveys over 20 years. *Thorax* 2001; 56: 569–71.
11. TSANAKAS J, FRENCH D, GRATSIU C, et al. Asthma schools in childhood asthma control in Greece. *Eur Resp J* 2000; 16 (Suppl. 31): 517s.
12. PAYNE DN, WILSON NM, JAMES A, HABLAS H, AGRAFIOTI C, BUSH A. Evidence for different subgroups of difficult asthma in children. *Thorax* 2001; 56: 345–50.
13. KOTANIEMI-SYRJANEN A, REIJONEN TM, KORHONEN K, KORPPI M. Wheezing requiring hospitalization in early childhood: predictive factors for asthma in a six-year follow-up. *Pediatr Allergy Immunol* 2002; 13: 418–25.